



U.S. Department
of Transportation
Federal Aviation
Administration

Advisory Circular

Subject: Instructions for Continued Airworthiness

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AC No: 33.4-1

Initiated By: ANE-110 **Change:**

1. PURPOSE. This advisory circular (AC) provides information and guidance on acceptable methods, but not the only methods of compliance with § 33.4 of the Federal Aviation Regulations, Title 14 of the Code of Federal Regulations. This section (§ 33.4) contains requirements for preparing Instructions for Continued Airworthiness (ICA's) for aircraft engines. Although this AC does refer to regulatory requirements that are mandatory, this AC is not, in itself, mandatory. This AC neither changes any regulatory requirements nor authorizes changes in or deviations from the regulatory requirements.

2. RELATED REGULATIONS, ORDERS and ADVISORY CIRCULARS.

- a. 14 CFR Part 21, Certification Procedures for Products and Parts,
- b. 14 CFR Part 33, Airworthiness Standards: Aircraft Engines,
- c. 14 CFR Part 43, Maintenance, Preventive Maintenance, Rebuilding, and Alteration
- d. 14 CFR Part 91, General operating and flight rules
- e. 14 CFR Part 119, Certification: Air carriers and commercial operators
- f. 14 CFR Part 121, subpart L, Maintenance, Preventive Maintenance, and Alterations

- g. 14 CFR Part 125, subpart G, Maintenance
- h. 14 CFR Part 135, subpart J, Maintenance, Preventive Maintenance, and Alterations
- i. FAA Order 8110.4A, Type Certification Process
- j. AC 20-1 14, Manufacturers' Service Documents

3. BACKGROUND.

a. In 1994, the FAA established a team comprised of engineers from the Aircraft Certification Service and airworthiness inspectors from the Aircraft Maintenance Division of the Flight Standards Service. The team was tasked to provide guidance to assist with the compliance requirements of §§ 21.50, 23.1529, 25.1529, 27.1529, 29.1529, 31.82, 33.4 and 35.4, and the Appendices of parts 23, 25, 27, 29, 33 and 35. This AC is an outgrowth of that team effort to provide the guidance on the preparation of ICA's.

b. This AC provides information and guidance to applicants for aircraft engine design approvals that may be used to demonstrate compliance with the requirements of §§ 33.4 and Appendix A to part 33, and 21.50(b) on the preparation of ICA's.

4. DISCUSSION.

a. The applicant for an aircraft engine type certificate must prepare ICA's as part of that aircraft engine's type certification process. The ICA's would provide information for proper maintenance that would ensure engines of that type design in an ongoing state of eligibility for installation on aircraft. Holders of aircraft engine type certificates use the Airworthiness Approval Tag (FAA Form 8130-3) to document that eligibility at the time of initial production. A new aircraft engine with an airworthiness approval tag is viewed as "airworthy", and adherence to the ICA's will play a key role in keeping that engine airworthy through its operational life, or in a state of "continued airworthiness."

b. The term "airworthy" has no specific statutory or regulatory definition. In order to use an Airworthiness Approval Tag on a new aircraft engine, however, the holder of the type certificate must first establish that the engine conforms to its type certificate, and is in a condition for safe operation. This two-part test constitutes a practical definition of "airworthiness", and is consistent with the test applied to the initial issuance

of an aircraft's standard airworthiness certificate, and in the context of adjudication of the question of aircraft airworthiness. Therefore, for the purpose of this AC, an aircraft engine is considered "airworthy" when the following two conditions are met:

(1) The engine conforms to its type certificate. An engine conforms to its type certificate when the engine configuration is consistent with the type design and other data that is part of the type certificate, as well as other approved data such as these data related to repairs, modifications or alterations.

(2) The engine is in a condition for safe operation. An engine is in a condition for safe operation when the condition of the engine considering factors such as wear, damage, and deterioration does not prevent the engine from demonstrating compliance with those requirements of part 33 that relate to the safe operation of the engine, and does not result in an unsafe condition to the aircraft. This means, for example, that a turbine engine in a condition for safe operation could still comply with the safety analysis required by § 3 3.75.

The contents of this AC is arranged in three sections corresponding to the regulations in §§ 21.50(b), 33.4, and Appendix A to part 33.

SECTION 1

INSTRUCTIONS FOR CONTINUED AIRWORTHINESS AND MANUFACTURER'S MAINTENANCE MANUALS HAVING AN AIRWORTHINESS LIMITATIONS SECTION (§ 21.50(b))

5. GUIDANCE FOR § 21,50(b).

a. General. Section 2 1.50(b) requires that the holder of a design approval for an aircraft engine for which application was made **after** January 28, 198 1, shall furnish at least one set of complete ICA's to the owner of each type of aircraft engine upon its delivery, or upon issuance of the first standard airworthiness certificate for the affected aircraft, whichever occurs later, and thereafter make the ICA's available to any other person required to comply with any of the terms of those instructions.

b. Aircraft Maintenance Manuals. It is acceptable for the engine TC holder to furnish to the aircraft manufacturer for incorporation into the aircraft maintenance manual, the instructions that deal with maintenance of the engine installed on an aircraft. If this

method is used however, the engine TC holder remains responsible for controlling the content and distribution of the engine section of the aircraft ICA's. The engine TC holder should establish a program, acceptable by the FAA, to control and distribute those sections of the aircraft ICA's that are used to show compliance with the engine TC requirements, including any component manuals. In this context, it should be clear that the aircraft manufacturer must adopt the engine TC holder's maintenance instructions, and should not alter those instructions. Also, only the engine TC holder may make changes to the engine maintenance portion of the aircraft ICA's, and the aircraft manufacturer should accurately incorporate those changes. In the event the engine TC holder does not or can not provide a program to control the content and distribution of the engine maintenance section of the aircraft ICA's, then the engine TC holder should produce and distribute its own engine ICA's. In either instance, the engine "overhaul" manual should always be provided separately by the engine TC holder, since it deals with maintenance of the uninstalled engines.

c. STC's and PMA's. Repairs and Alterations. ICA's are also necessary for supplemental type certificates (STC's), part manufacturer approvals (PMA's), design changes, and any repairs or alterations that introduce new features that the existing ICA's do not adequately cover. In such instances, it is the responsibility of the STC or PMA holder, or the individual who receives the repair or alteration approval, to produce the required ICA's. The process of reviewing and acceptance of ICA's for STC's, PMA's, design changes, and repairs or alterations will be the same as that described in section 6.b. of this AC for type certifications. To assess the safety of such changes for type certification basis, the required ICA's should be in accordance with the current regulatory amendment. In cases where it is determined that the existing ICA's are adequate for the continued airworthiness of the altered product, then that determination should be noted in the design change approval to ensure the continued airworthiness of the product, for example in the "limitations and conditions" section of STC certificate.

SECTION 2

INSTRUCTIONS FOR CONTINUED AIRWORTHINESS UNDER § 33.4

6. GUIDANCE FOR § 33.4, INSTRUCTIONS FOR CONTINUED AIRWORTHINESS.

a. In the context of a certification program under part 33, the ICA's prepared by the applicant should be submitted to the FAA for acceptance before the issuance of the

engine TC. The ICA's may be incomplete at the time of type certification if a program exists to ensure their completion prior to delivery of the first aircraft with the engine installed, or upon issuance of a standard airworthiness certificate for the aircraft with the engine installed, whichever occurs later. The rule accommodates applicants who could not complete the ICA's until a specific aircraft application is identified. However, every effort should be made to complete the ICA's at the time of engine TC issuance. For airworthiness certification, it is not acceptable for the FAA to issue the certificate of airworthiness for an aircraft without complete ICA's. However, the availability of overhaul section, or manual portion of the ICA's for overhaul or other forms of heavy maintenance may be delayed until after the engine has entered service. In such cases, the applicant should provide a schedule that is acceptable to the FAA to complete the overhaul manual or section, normally within six months after the engine entering service. Meanwhile, no person, including the engine manufacturer, should be allowed to overhaul or perform any form of heavy maintenance without an overhaul or heavy maintenance manual; and the manual, when completed, becomes part of the ICA's. The engine TCDS should incorporate a note prohibiting the overhaul or other form of heavy maintenance of engines until the overhaul manual is available.

b. Applicants should submit ICA's for acceptance to the Aircraft Certification Office (ACO) responsible for overseeing that type certification project. That same ACO will approve any airworthiness limitations and associated maintenance procedures. The Aircraft Evaluation Group (AEG) will review the ICA's and make recommendations on the maintenance and operational aspects of the ICA's. The ACO and AEG offices are jointly responsible for determining the acceptability of the ICA's, however, the final acceptance of the completed ICA's is the responsibility of the ACO.

c. If the engine ICA's are not completed prior to the time the engine TC is issued, applicants should include as part of the plan for completion, a process for keeping the ACO responsible for certifying the aircraft informed of the status and acceptance of the engine ICA's. Only with the ICA's completed, may the FAA issue a certificate of airworthiness on the aircraft. If an engine TC is issued before the ICA's are completed, a statement should be placed on the engine TCDS, stating that the engine ICA's are not completed and any aircraft with that engine installed is not eligible for airworthiness certification until the engine ICA's are completed and accepted by the FAA office certifying the engine,

SECTION 3**APPENDIX A TO PART 33****7. GUIDANCE FOR A33.1 - GENERAL.**

a. The ICA's should include instructions for all engine parts. The instructions should provide for the continued airworthiness of the entire engine to the extent that the lack of specific instructions for any given part should not adversely **affect** an operator's ability to maintain the engine in an airworthy condition.

b. The determination of need for instructions regarding parts, subassemblies, assemblies or modules should include consideration of airworthiness limitations, safety assessments, classification of parts, and compliance requirements. Each part needs to be addressed either individually or as part of a group or system.

c. Specific inspections with "threshold" or "opportunity" schedule requirements should be clearly established in the ICA's. Additionally, when the engine is in the shop and the engine parts and components are exposed, the parts and components should be subjected to appropriate inspections to determine their eligibility for reinstallation in an engine for continued service. An adequate inspection program or opportunity inspections, is essential for the continued airworthiness of the engine.

d. The applicant should provide in the ICA's, a means to ensure accurate configuration control that complies with the type certificate for all parts, components, and any combinations of parts or components, allowing the engine configuration to be properly identified during assembly or replacement.

e. For highly complex engine parts and components, the ICA's may be **furnished** by the manufacturers of those parts or components through the engine TC holder. However, if this is done, the engine TC holder's ICA's should clearly cross-reference the part or component manufacturer's instructions in the ICA's by revision level and date of publication, since those instructions become part of the complete ICA's as required by § 33.4, and should also be furnished to the owners or operators under § 2 1.50(b).

f. To comply with § 33.4, the engine TC holder should have a program for controlling the content and distribution of all engine ICA's, including part or component manuals or sections. The procedure for how to distribute the changes to the ICA's should

be documented in the applicant's internal procedures manual. The program for managing changes to the ICA's is not required to be included in the ICA's that are distributed to owners and operators, but the revision history records, including revision number or level, **affected** pages or sections, and dates, should be included in the ICA's. These revision history records are important to establish the content of the "current manual," required to be used under part 43.

8. GUIDANCE FOR A33.2 - FORMAT.

a. The ICA's should be organized and cross-referenced in a clear, logical and usable fashion. Service Bulletins (**SB's**), as described in AC 20-114, form a different class of service document than those required for type certification, and it is not recommended as a substitute for acceptable ICA's. Service Bulletins may be used as a vehicle for disseminating information, although the use of a temporary manual revisions is more appropriate for this purpose. It is not considered an undue burden to the TC holder to incorporate the appropriate information directly into the manuals using temporary manual revisions instead of using **SB's**. However, should the applicant desire to use **SB's** for incorporation by reference into the ICA's, the following criteria should be as follows:

(1) The SB referenced in the ICA's should be version specific. The use of a future revision note such as "the latest revision" is not acceptable.

(2) The technical content of the SB should be FAA approved.

(3) The SB should be distributed to the all owners of the engine as provided in § 21.50(b).

b. As noted in § A33.4, Airworthiness Limitations, there should be a "principal manual" in the ICA's when there are multiple volumes. To provide for "practical arrangement," that principal manual should also include a description of the break down and application of the manuals or sections, including a table of contents listing all of the other manuals or sections that constitute the complete ICA's under § 33.4.

c. The FAA has accepted a variety of formats including the Air Transport Association (ATA) 100 Specification. The documents that constitute the complete ICA's need to be clearly identified as containing the ICA's required under § 33.4, regardless of format used.

9. GUIDANCE FOR A33.3 - CONTENT. It should be noted that the ICA's are intended to be a complete document, therefore it should be emphasized that the

“information” must be contained in the manuals or sections, and should not be in unreferenced documents, such as service letters. ICA’s must be prepared using the English language, but, metric system units may be used for the technical aspects of the product in the areas of design, production, operation, or maintenance.

a. Guidance for A33.3(a) Engine Maintenance Manual or Section.

(1) A33.3(a)(1) and(a)(2). The description of the engine features and data, its components, systems, and installations should contain sufficient details to the extent necessary to perform engine maintenance. This may include any necessary warnings, cautions and guidance, such as applicable metric system or U.S. Standard System requirements. This is necessary to meet the regulatory requirements relating to the performance of maintenance for recording and surveillance of the actual work performed, and the methods, techniques and practices employed.

(2) A33.3(a)(3). The instructions should also address all accessories, cover-plates, etc., that may be attached to, mounted on, or driven by the engine, since their interfaces affect the engine. Complete installation instructions are required for those parts and accessories that are a part of the engine type design. Minimum interface instructions and any appropriate specifications, warnings, or cautions should be provided for those areas where non-engine TC accessories or parts could be installed on the engine at a later date.

(3) A33.3(a)(4). The ICA’s should provide adequate information in engine control and operations described in this paragraph to the extent necessary to perform the maintenance at the levels specified in the ICA’s.

(4) A33.3(a)(5). The servicing information includes both engine type design parts, and systems or components that are not part of the engine TC, but are installed integrally with or dependent upon the engine. For example, shared oil systems with accessories or propellers, gear drive interfacing with the engine. In these instances, it is important to coordinate with the ACO that is responsible for the engine installation and the acceptance of the servicing information.

(5) A33.3(a)(6).

(a) Scheduling information need not be provided for “every part”, but rather the scheduling information should provide for the continued airworthiness of the entire engine to the extent that the lack of specific scheduling information on any part

will not adversely affect the continued airworthiness of the engine. The substantiation for scheduling information may be derived from engine certification testing, development testing, service experience of the same or similar type design engine, or a combination thereof. The ICA's should state that those parts not scheduled need not be serviced other than to be inspected when exposed.

(b) A single top level "overhaul" time between overhaul (TBO) for the engine could be sufficient when it provides an appropriate interval to ensure the continued airworthiness of the entire engine.

(c) An applicant should provide one or several scheduling options for the ICA's. The engine parts, components and accessories should be monitored and serviced while installed, otherwise the products should be scheduled for appropriate maintenance or overhaul to ensure their continued airworthiness. For example, this could mean "soft times" for each module, assembly, sub-assembly, accessory, or part of the engine. If the engine is taken off aircraft, then the ICA's should provide maintenance or overhaul instructions that are necessary to determine their eligibility for reinstallation in an engine and continued service use. This could also mean that the disassembly of the engine, module or component assembly to the piece part level may be required before returning the engine to service if the exposure occurs after a considerable number of hours or cycles in service. Refer to paragraphs in Section 9b for more information.

(d) The applicant may refer to a component manufacturer as the source for the scheduling information. However, in that case the manufacturer's component manual is part of the ICA's and the TC holder remains responsible, even though the information contained in the component manual originates with the component manufacturer. It is the responsibility of TC holder to provide the scheduling information in the principal ICA's (e.g., engine maintenance manual), defining when the maintenance referenced in the component manual should be performed. There may be instances where only the original equipment manufacturer (OEM) is approved to work on a part or component due to the complexity of the maintenance task. In such instance, when approved by the cognizant ACO, only the recommended scheduling periods and the manufacturer's name and address would be referenced in the ICA's.

(e) The ICA's should clearly **identify** and reference any component manuals that are part of the ICA's. In such cases, the TC holder remains responsible to control the content and changes in component manuals in accordance with the program

provided to the FAA under section **A33.1(c)** of the Appendix to part 33. The TC holder may work in conjunction with the component manufacturer to distribute changes to component manuals.

(f) The TC holder should clearly define what level or amount of inspection and repair or replacement of parts constitutes an “overhaul”. This is critical for several reasons, Section 33.19 requires that an engine be designed and constructed to minimize the development of an unsafe condition between overhaul periods, which includes components and accessories that are part of the type certificate. Further, for the issuance of an export airworthiness approval on a “newly overhauled” product defined under § 21.321(b)(4), it is necessary to know what work constitutes a complete overhaul of the product in order to make the correct airworthiness determination for export. Section 43.2 describes in general terms what constitutes overhaul, but the ICA’s should detail what work on the particular engine type meets that definition. The recommended overhaul periods should be included in the ICA’s, and the necessary cross-references would typically not be in the airworthiness limitations section, unless it was necessary to prevent a failure or malfunction that could directly lead to an unsafe or hazardous condition.

(g) The applicant must include an inspection program in the ICA’s necessary to provide the continued airworthiness of the engine. The initial maintenance inspection requirements, derived from § 33.90 testing, in conjunction with other certification tests, analyses, and service experience, if available, are typically used to develop the inspection program for parts, subassemblies, assemblies or modules. The program need not be defined in the airworthiness limitations section. However, such recommendations should cross-reference any airworthiness limitations that are required to be accomplished in conjunction with the inspection program. The development of an adequate inspection program should also include subsequent inspections (periods, frequency, and parts involved) and, when applicable, the procedures for increasing inspection periods, such as a sampling program or service experience of the same or similar type design engine. For systems, it is necessary to include an assessment of the entire system which may require joint engine, aircraft, or propeller systems review and coordination with the engine installing ACO.

(6) **A33.3(a)(7)**. The troubleshooting information should assure that the engine and its modules, assemblies, sub-assemblies and parts perform their intended functions within the approved flight envelope and prevent engine malfunctions. The probable malfunctions that could occur should be addressed either to **rectify** them or replace the affected part or component before continued operation.

(7) A33.3(a)(8). The applicant should provide in the ICA's a means to ensure configuration control such that the proper parts, components, and any combinations are identified and comply with the type certificate.

(8) A33.3(a)(9). The list of tools should be adequate enough to complete the work. The list may consist of several lists located in the appropriate sections of the ICA's where the work is described. It is recommended however, that the list of tools and equipment be centrally located in the front of the manual or section, to better facilitate locating and ordering tools and equipment. Also, the list should include a cross-reference to the appropriate section where directions to the method of using each tool is located. Special tools should be highlighted, since there is a specific regulatory requirement for the use of a special tool when performing maintenance.

b. A33.3(b). Engine Overhaul Manual or Section.

It is not necessary to define a single overhaul time for the entire engine, or even modules or assemblies. However, the experience has shown that every part of the engine is exposed for inspection at some point during the life of the engine. The TC holder should clearly define what level or amount of inspection and repair or replacement of parts constitutes an "overhaul". Utilizing the modular maintenance concept is a method of achieving this overhaul in an efficient manner, though each part may effectively be overhauled at different times or cycles. The recommended overhaul periods should be included in the ICA's, and the necessary cross-references would typically not appear in the airworthiness limitations section, unless it was necessary to prevent a failure or malfunction that could directly lead to an unsafe or hazardous condition.

Specific inspections with "threshold" or "window" schedule requirements should be established in the ICA's. The "window" schedule, for example, may be established to coincide with a life limited component removal. Additionally, when an engine is in the shop and areas of the engine are exposed on an opportunity basis, parts and components of those areas should be subjected to appropriate inspections to determine the eligibility of a part or assembly for reinstallation and continued service use.

(1) A33.3(b)(1). The engine overhaul manual or section should contain sufficient details to the extent necessary for disassembly, overhaul and reassembly to be performed. This also includes any necessary warnings, cautions, and guidance.

(2) A33.3(b)(2):

(a) The determination of adequate inspection criteria should provide for appropriate inspection of each part of the engine, subassembly, assembly, and module as well as systems and components. Inspections should **identify** the required action at each level, such as part replacement, repair, or further detailed inspection.

(b) The accuracy and reliability of inspection techniques need to be consistent with the criticality of the parts being inspected, and the types of defects for which the inspection is being conducted. During inspections, when special emphasis or a higher awareness is needed, the ICA's should clearly identify those critical parts and key features or areas. The cleaning could have a significant effect on inspectability, since improper cleaning can result in missed inspection of potentially hazardous defects. Therefore, the proper cleaning methods should be emphasized with the appropriate cautions where improper cleaning could be a factor.

(3) A33.3(b)(3). The overhaul manual should contain details for all fits and clearances relevant to the engine and components, structural integrity, and functionality a for new and worn parts. While these fits and clearances may be identified in the manual as "limits," they are not considered "airworthiness limitations". However, these limits, if exceeded, may mean that the component or part is not airworthy. Therefore, such limits need to be analyzed and adjusted accordingly.

(4) A33.3(b)(4):

(a) The main objective of this requirement is that worn or substandard parts that do not meet the ICA's inspection limits can not be returned to service. Such parts should be either replaced or repaired in order to make the engine airworthy. While the ICA's need not contain repairs for all engine parts, the ICA's should **identify** when or under what conditions parts must be replaced or repaired. If a part or component fails to meet the requirements in the Inspection/Check section of the ICA's, replacement is an acceptable alternative to repair in order to maintain the continued airworthiness of the engine.

(b) Repairs in the ICA's should be complete, and may include personnel training requirements, but should not contain provisions driven solely by economic concerns. When the repair is accomplished in accordance with the ICA's, the result is a part that conforms to the approved type design data, and if it is safe for operation would constitute an airworthy part.

(c) The FAA may allow, and approve of other repair data that is not part of the TC and is not reflected in the ICA's. However, when design change data for repair or alteration constitutes a substantial change to the type design, and therefore could be considered major, the need for information in the ICA's for such a repair or alteration should be evaluated, since any repair or alteration could introduce a new feature that does not exist in the original type design. This is particularly true for an STC. Any major design change data, whether in support of a repair or alteration, which is substantive enough to require significant additions to the ICA's, should be approved as an STC or amended TC.

(5) A33.3(b)(5). The ICA's should also contain a means to ensure configuration control such that the proper parts, components, and any combinations that comply with the type design, are identified during assembly or replacement.

(6) A33.3(b)(6):

(a) The ICA's should contain test acceptance criteria that are identified as "limits," even though not "airworthiness limitations." However, changes to such engine test acceptance criteria that is safety related should be considered major design changes and, may be changed with appropriate FAA approved data to substantiate the change.

(b) The manual or section should include instructions for testing an engine after overhaul. This should also include any minimum testing requirements for a single overhauled component or model when applicable.

(7) A33.3(b)(7). Any special containers, equipment and tools that may be necessary to comply with the instructions for storage should be included. The storage limits should also include any environmental restrictions, such as limits for temperature, humidity, etc.

(8) A33.3(b)(8). The list of tools should be adequate to complete the work. The list may consist of several lists located in the appropriate sections of the ICA's where the work is described. It is recommend however, that the list of tools necessary for overhaul is centrally located in the front of the manual to facilitate locating and ordering them. Also, the list should include a cross-reference to the appropriate section where the directions to the method of using each tool is located or where the tools are utilized. Special tools should be highlighted, since there is a specific regulatory requirement for the use of a special tool when performing maintenance.

10. GUIDANCE FOR A33.4 - AIRWORTHINESS LIMITATIONS SECTION.

a. Sections 43.16 and 91.403 provide that the requirements stated in an airworthiness limitations section (ALS) must be complied with, however, "inspection intervals". and "maintenance actions" required by an ALS may be adjusted or changed under an FAA approved alternative program. "Airworthiness limitation mandatory replacement times," however, may not be changed without FAA engineering approval. The ALS should include only information that is approved, by the cognizant FAA certificating office.

b. The ALS should appear in the "Principal Manual." If the ICA's consist of an engine **maintenance** manual and an engine overhaul manual, the principal manual should be the engine maintenance manual. Although the owners must receive all manuals in accordance under § 21.50(b), they may only be concerned with the day to day maintenance instruction contained in the engine maintenance manual. The ALS may appear in both manuals, which is acceptable as long as both ALS are identical and revised concurrently. The ALS should be prominently located, should be entitled "The Airworthiness Limitation Section" and should be identified as having been "FAA Approved" at the beginning of the section or on the cover page of the section.



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